



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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Applicant : COLLINS ET AL. Docket No.: 00-682

Serial No. : 10/028,730 Examiner : M. Koczo, Jr.

Filed : Oct. 19, 2000 Art Unit : 3746

Conf. No. : 4112

For : COMPRESSOR PROTECTION MODULE

AND SYSTEM AND METHOD INCORPORATING SAME

CORRECTED AMENDMENT UNDER 37 C.F.R. 1.116

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313

"D"
NOT Entered

Dear Sir:

This paper is submitted responsive to the Official Action mailed January 14, 2005 and having a shortened statutory period for response set to expire on April 14, 2005, said period having been extended in accordance with the accompanying request for extension of time so as to expire on May 14, 2005.

Amendments to the Claims are reflected in the listing of claims which begins on page 2 of this paper.

Remarks/Arguments begin on page 13 of this paper.

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Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Previously presented) An apparatus for monitoring a compressor, comprising:

a plurality of sensor inputs for receiving input regarding operating parameters of a compressor;

at least one control action output for sending a control action to said compressor; and

a control member communicated with said plurality of sensor inputs and said control action output, said control member being adapted to analyze input from said plurality of sensor inputs, to determine a control action based upon said input and to send said control action to said at least one control action output, wherein said control action includes actions for immediate protection, wherein a control action to shut down said compressor is issued, and control actions for prognostic protection, wherein a signal is issued while said compressor is continued to be operated.

2. (Original) The apparatus of claim 1, wherein said control member is adapted to receive input comprising compressor discharge pressure, compressor discharge temperature, compressor suction pressure, compressor suction temperature, oil pressure and a compressor on/off input signal.

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3. (Original) The apparatus of claim 2, wherein said control member includes a memory storing a plurality of potential control actions, a plurality of adjustable operating parameters and a plurality of sensor input value combinations corresponding to said plurality of potential control actions, and a processor adapted to compare said input to said sensor input value combinations and select said control action from said plurality of control actions.

4. (Currently amended) An apparatus for monitoring a compressor, comprising:

a plurality of sensor inputs for receiving input regarding operating parameters of a compressor;

at least one control action output for sending a control action to said compressor; and

a control member communicated with said plurality of sensor inputs and said control action output, said control member being adapted to analyze input from said plurality of sensor inputs, to determine a control action based upon said input and to send said control action to said at least one control action output, wherein said control member is adapted to receive input comprising compressor discharge pressure, compressor discharge temperature, compressor suction pressure, compressor suction temperature, oil pressure and a compressor on/off input signal, wherein said control member includes a memory storing a plurality of potential control actions, a plurality of adjustable operating parameters and a plurality of sensor input value combinations corresponding to said plurality of potential

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control actions, and a processor adapted to compare said input to said sensor input value combinations and select said control action from said plurality of control actions, wherein said plurality of potential control actions includes a compressor shut down command, operation parameter adjusting commands and commands ~~for~~ indicating that maintenance is needed.

5. (Currently amended) The apparatus of claim 4, wherein said control member is further adapted to store information regarding at least one of sensor input values, said control action and said commands indicating that maintenance is needed alarms in said memory.

6. (Original) The apparatus of claim 3, further comprising a communication member associated with said control member and adapted to allow communication between said control member and a remote location.

7. (Original) The apparatus of claim 6, wherein said plurality of control actions includes a command to issue a signal through said communication member.

8. (Original) The apparatus of claim 1, further comprising a display member communicated with said control member, said control member being adapted to display a message on said display member corresponding to at least one of said input and said control action, and an indication of at least one compressor shut down or

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maintenance alarms; and to allow adjustment of at least one of said adjustable operating parameters.

9. (Original) The apparatus of claim 1, wherein said control member is adapted to identify a flooded start condition from said input.

10. (Original) The apparatus of claim 9, wherein said input includes suction temperature, suction pressure, discharge pressure, discharge temperature and oil pressure data, and said control actions include issuing a flooded start warning, altering an operating parameter of said compressor, shutting down said compressor, and combinations thereof.

11. (Original) The apparatus of claim 1, wherein said control member is adapted to identify a liquid slugging condition from said input.

12. (Original) The apparatus of claim 11, wherein said input includes suction temperature, suction pressure, discharge pressure, discharge temperature and oil pressure data, and said control actions include issuing a liquid slugging warning, altering an operating parameter of said compressor, shutting down said compressor, and combinations thereof.

13. (Original) The apparatus of claim 1, wherein said control member is adapted to compare discharge temperature

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from said input to a discharge temperature set point and to control a liquid injection valve on said compressor based upon results of the comparison.

14. (Previously presented) An apparatus for monitoring a compressor, comprising:

a plurality of sensor inputs for receiving input regarding operating parameters of a compressor;

at least one control action output for sending a control action to said compressor; and

a control member communicated with said plurality of sensor inputs and said control action output, said control member being adapted to analyze input from said plurality of sensor inputs, to determine a control action based upon said input and to send said control action to said at least one control action output, wherein said control member is adapted to compare discharge temperature from said input to a discharge temperature set point and to control a liquid injection valve on said compressor based upon results of the comparison, wherein said control member is adapted to open said liquid injection valve when said discharge temperature is greater than said set point.

15. (Original) The apparatus of claim 13, wherein said control member has a memory storing expected reactions to control actions taken on said liquid injection valve, and wherein said control member is adapted to compare actual change in said discharge temperatures to said expected

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reactions so as to identify a malfunctioning liquid injection valve.

16. (Original) The apparatus of claim 1, wherein said control member is adapted to identify a liquid floodback condition from said input.

17. (Previously presented) A method for monitoring a compressor, comprising the steps of:

obtaining input regarding a plurality of compressor operating parameters;

feeding said input to a control member;

analyzing said input with said control member to determine a control action based upon said input; and

carrying out said control action on said compressor, wherein said control action includes actions for immediate protection, wherein a control action to shut down said compressor is issued, and control actions for prognostic protection, wherein a signal is issued while said compressor is continued to be operated.

18. (Original) The method of claim 17, wherein said input comprises compressor discharge pressure, compressor discharge temperature, compressor suction pressure, compressor suction temperature, oil pressure and a compressor on/off input signal.

19. (Original) The method of claim 18, wherein said control member includes a memory storing a plurality of

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potential control actions and a plurality of sensor input value combinations corresponding to said plurality of potential control actions; and wherein said control member selects said control action from said plurality of potential control actions.

20. (Previously presented) A method for monitoring a compressor, comprising the steps of:

obtaining input regarding a plurality of compressor operating parameters;

feeding said input to a control member;

analyzing said input with said control member to determine a control action based upon said input; and

carrying out said control action on said compressor, wherein said plurality of potential control actions include a compressor shut down command, operation parameter adjusting commands and commands for indicating that maintenance is needed, wherein said input comprises compressor discharge pressure, compressor discharge temperature, compressor suction pressure, compressor suction temperature, oil pressure and a compressor on/off input signal, wherein said control member includes a memory storing a plurality of potential control actions and a plurality of sensor input value combinations corresponding to said plurality of potential control actions; and wherein said control member selects said control action from said plurality of potential control actions, wherein said plurality of potential control actions include a compressor

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shut down command, operation parameter adjusting commands and commands for indicating that maintenance is needed.

21. (Original) The method of claim 19, further comprising the step of storing information regarding at least one of said input and said control action in said memory.

22. (Original) The method of claim 17, wherein said input is obtained from sensors positioned within about 1 foot of said compressor.

23. (Original) The method of claim 17, further comprising the steps of enabling communication of said control member with a remote location, and at least one of (a) sending information related to said control action to said remote location and (b) allowing access to information regarding said control action from said remote location.

24. (Previously presented) In combination, a compressor and control module system, comprising:

a compressor; and

a control module comprising a plurality of sensor inputs for receiving input from said compressor; at least one control action output for conveying control actions to said compressor; and a control member communicated with said plurality of sensor inputs and said control action output, said control member being adapted to analyze input from said plurality of sensor inputs, to determine a

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control action based upon said input and to send said control action to said at least one control action output, wherein said control action includes actions for immediate protection, wherein a control action to shut down said compressor is issued, and control actions for prognostic protection, wherein a signal is issued while said compressor is continued to be operated.

25. (Currently amended) The system of claim 24, wherein said control member is adapted to compare discharge temperature from said input to a discharge temperature set point and to control a liquid injection valve on said compressor based upon results of the comparison, and has a memory storing expected reactions to control actions taken on said liquid injection valve, and wherein said control member is adapted to compare actual change in said discharge temperatures to said expected reactions so as to identify a malfunctioning liquid injection valve.

26. (Original) The system of claim 24, further comprising a plurality of sensors associated with said compressor and connected to said sensor inputs.

27. (Original) The system of claim 24, wherein said plurality of sensors comprises sensors for measuring compressor discharge pressure, compressor discharge temperature, compressor suction pressure, compressor suction temperature, oil pressure and compressor on/off input signal.

28. (Original) The system of claim 24, wherein said control member includes a memory storing a plurality of potential control actions and a plurality of sensor input combinations corresponding to said plurality of potential control actions.

29. (Previously presented) In combination, a compressor and control module system, comprising:

a compressor; and

a control module comprising a plurality of sensor inputs for receiving input from said compressor; at least one control action output for conveying control actions to said compressor; and a control member communicated with said plurality of sensor inputs and said control action output, said control member being adapted to analyze input from said plurality of sensor inputs, to determine a control action based upon said input and to send said control action to said at least one control action output, wherein said control member includes a memory storing a plurality of potential control actions and a plurality of sensor input combinations corresponding to said plurality of potential control actions, wherein said plurality of potential control actions include a compressor shut down command, operation parameter adjusting commands and commands for indicating that maintenance is needed.

30. (Original) The system of claim 28, wherein said control member is further adapted to store information

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regarding at least one of said input and said control action in said memory.

31. (Original) The system of claim 24 further comprising a communication member associated with said control member and adapted to allow communication between said control member and a remote location.

32. (Original) The system of claim 31, wherein said at least one control action includes a command to issue a signal through said communication member.

33. (Original) The system of claim 24, further comprising a display member communicated with said control member, said control member being adapted to display a message on said display member corresponding to said control action.

34. (Original) The system of claim 33, wherein said message includes a value of at least one sensor input, status of at least one control output and an indication of at least one compressor shut down or maintenance alarm.

35. (Previously presented) The system of claim 24, wherein the compressor has a compressor chassis and wherein the control module is mounted to the compressor chassis.

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36. (Previously presented) The system of claim 29,
wherein the compressor has a compressor chassis and wherein
the control module is mounted to the compressor chassis.

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ARGUMENTS/REMARKS

This paper is submitted responsive to the Official Action mailed January 14, 2005.

Reconsideration of the application in light of the accompanying remarks and amendments is respectfully requested.

In the aforesaid action, the Examiner objected to the drawings as failing to show the subject matter of claims 35 and 36. The Examiner states that "no chassis structure is shown and it is not even evident that the module is attached to the chassis". Figure 1 shows chassis 10 with module 12 mounted thereon. This is also described in the specification on page 3, the beginning of the last paragraph. Claims 35 and 36 do not claim any more than that which is shown and described, and therefore these claims and the drawings of the application are submitted to be proper. Reconsideration and withdrawal of this objection is respectfully solicited.

The Examiner also rejected claims 35 and 36 under 35 USC 112, first paragraph for failing to comply with the written description requirement. The Examiner asserts that the contents of claims 35 and 36 were not described in the specification in such a way to reasonably convey to one skilled in the relevant art that the inventors had possession of the claimed invention. The Examiner further asserts that there is no basis in the original specification for the structure as recited in these claims. Reference is made to the specification and drawings as mentioned above, and reconsideration and withdrawal of this

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rejection is respectfully requested. Clearly, the claims calling for the module to be mounted to a compressor chassis are supported by the specification which states that the drawings show a compressor chassis 10 and a compressor 12, and the drawings show module 12 on the chassis 10.

The Examiner rejected claims 5 and 25 under 35 USC 112 second paragraph as lacking antecedent basis for certain language therein. These claims, as well as claim 4, have been amended to address this issue and it is submitted that these claims are now in proper form. Entry of these amendments and withdrawal of the rejection under 35 USC 112, second paragraph is respectfully requested.

In the aforesaid action, the Examiner rejected various claims of the application as anticipated by U.S. Patent No. 5,820,352 to Gunn et al., and rejected other claims as obviated by a combination of Gunn et al. with secondary prior art references.

In accordance with the present invention, a system and method are provided whereby specific sensor input is obtained from a compressor during operation, and this input is fed to a protection module which is adapted to detect conditions requiring immediate and/or prognostic actions.

In instances where immediate protection is needed, the compressor can be shut down. In other conditions, prognostic protection is appropriate and operation of the compressor can be continued, perhaps at different operating parameters, while a call for maintenance is issued so that

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the problem can be addressed without interruption of the compressor.

In a preferred embodiment, the invention is provided as a module for communicating with an existing compressor to provide the desired protection. Thus, the present invention contemplates modular and after-market applications which are not possible with hard wired or integrated systems such as the teaching of Gunn et al.

Gunn et al. teach a detailed process for controlling discharge pressure. Any similar subject matter to that of the present claims is hard wired or integrated into the system of Gunn et al., with no suggestion of adaptation to the scope of the present claims on this feature.

The independent claims of the present invention are drawn to a system and apparatus wherein the desired protection is incorporated into a module, rather than hard wired into a particular system or the like. This allows for aftermarket installations and is a distinction from the art of record which is not disclosed or suggested by same.

Dependent claims 35 and 36 are drawn to the particular modular aspect of the invention, wherein the module is mounted adjacent to a compressor chassis.

The Examiner has relied upon the teachings of Heath et al. for teaching that the present invention is in the form of a module attached to a compressor chassis as claimed in the present claims. The Examiner suggests that it would have been obvious to take the hard-wired configuration of the Gunn et al primary reference and modify it based upon Heath et al. so as to be a module. A review of Heath et al

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reveals that although this document uses the words "chassis" and "module", they are in a completely different context than the present application. The chassis referred to is clearly not a compressor chassis, but rather a housing for the overall electronics of the device. Further, the "modules" referred to are separate components of the overall control device. Therefore, it is respectfully submitted that the combination of Gunn et al with Heath et al. does not arrive at the subject matter of the claims of the present application, all of which are drawn to a compressor protection module, and claims 35 and 36 of which specifically call for the protection module to be mounted to the chassis of the compressor.

An earnest and thorough attempt has been made by the undersigned to resolve the outstanding issues in this case and place same in condition for allowance. If the Examiner has any questions or feels that a telephone or personal interview would be helpful in resolving any outstanding issues which remain in this application after consideration of this amendment, the Examiner is courteously invited to telephone the undersigned and the same would be gratefully appreciated.

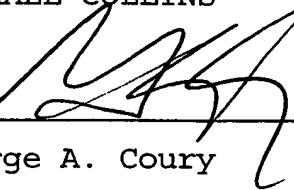
It is submitted that the claims as amended herein patentably define over the art relied on by the Examiner and early allowance of same is courteously solicited.

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If any additional fees are required in connection with this case, it is respectfully requested that they be charged to Deposit Account No. 02-0184.

Respectfully submitted,

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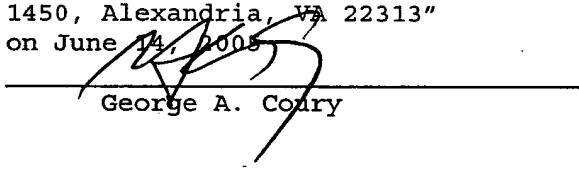
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Date: June 14, 2005

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: "Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313"

on June 14, 2005


George A. Coury